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PALYNOTAXONOMY OF THE GENUS *BUTEA* ROXB. EX WILLD. (*S.L.*) (FABACEAE)

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ABSTRACT

Examined the pollen morphology of 5 species of *Butea* Roxb. ex Willd. (*s.l.*) from India. The pollen grains are 3-zonocolporate and prolate spheroidal in all the species, however, three exine morphotypes have been recognised. The taxonomic status of the genus is discussed and the seggetation of sections *Meizotropis* and *Spatholobus* from *Butea* is supported.

INTRODUCTION

The genus *Butea* was proposed by Koenig (in Sched.) with one tree species from India, *Butea frondosa*, the 'Palas' or 'Dhak'. Roxburgh (1792, 1795) described a second species *B. superba*, a climber in addition to *B. frondosa*. Willdenow (1802) validated the genus *Butea* and attributed the two species to Roxburgh. The nomenclatural and taxonomical aspects of the genus were discussed in detail by Sanjappa (1988). In this paper the names and synonyms are cited under Material and Methods.

In 1814 Roxburgh added one more species *B. parviflora*. Later Buchanan-Hamilton (1830) collected a new species *B. minor*, for which Voigt (1845) gave a generic status, *Meizotropis buteiformis* ('buteaeformis').

Bentham (1852, 1865) unaware of the publication of *Meizotropis* Voigt, treated *B. frondosa* (*B. monosperma*), *B. superba* and *B. minor* under *Butea*, while *B. parviflora* was referred to another genus *Spatholobus* Hassk. Later Taubert (1894) followed Bentham and clearly indicated that *Meizotropis* Voigt is synonymous to *B. minor*.

Prain (1908) while adding a new species *B. pellita* Hook. f. ex Prain, reassessed the genera *Butea* Roxb. ex Willd., *Meizotropis* Voigt, and *Spatholobus* Hassk. He merged *Meizotropis* with *Butea* and divided the genus *Butea* into two sections *Eubutea* and *Meizotropis*. Accepting the Prain's views Blatter (1929) in his revision emended the circumscription of *Butea* on the basis of number of ovules and included *Spatholobus* Hassk. as a third section under *Butea*. Later *Spatholobus* Hassk. was treated as a distinct genus by Hutchinson (1964), Lackey (1981) and by Ridder-Numan and Wiriadinata (1985). Recently Sanjappa (1988) revised the genera *Butea* and *Meizotropis* and upheld *Meizotropis* as a distinct genus, as proposed by Voigt.

The pollen morphological study has been taken up in view of the above difference of opinions on the status and limitation of *Butea* Roxb. ex Willd. (*s.l.*). Previous pollen morphological studies are mostly confined to the species *B. monosperma* (Lam.) Taub. (*B. frondosa* Roxb. ex Willd.), *B. parviflora* Roxb. ex DC. and *B. superba* Roxb. ex Willd. (Erdtman, 1952 ; Vishnu-Mittre and Sharma, 1962 ; Rao and Shukla, 1975 ; Graham and Tomb, 1977 ; Baudet,

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1978; Tewari and Nair, 1978 & 1979; Ferguson and Skvarla, 1981). In this study 5 species of *Butea* (*s.l.*) representing the three sections Eubutea, Meizotropis and Spatholobus of Blatter (1929), have been examined.

MATERIAL AND METHODS

Pollen material was collected from the herbarium specimens and from the living plants in the Indian Botanic Garden (IBG), Howrah. Pollen preparations for the Light microscopic studies are made by acetolysis method (Erdtman, 1952). For SEM studies acetolysed pollen are coated with gold and observed with Philips SEM 500.

Specimens examined :

1. **B. buteiformis** (Voigt) Grierson & Long. C. B. Clarke (*B. minor* Buch-Ham. ex Baker; *Meizotropis buetiformis* Voigt) 44179B (CAL).
2. **B. monosperma** (Lam.) Taub. G. V. S. Murthy, Fresh (IBG). (*B. frondosa* Roxb. ex Willd.).
3. **B. parviflora** Roxb. ex DC. Mohanan, 52693 (CAL). [*Spatholobus parviflorus* (Roxb. ex DC) Kuntze].
4. **B. pellita** Hook. f. ex Prain A. E. Osmaston 1252 (DD).
5. **B. superba** Roxb. ex Willd. 1. R. S. Hole 224 (CAL); 2. Inayat 21467 (CAL); 3. G. V. S. Murthy, Fresh (IBG).

POLLEN DESCRIPTIONS

Section *Eubutea* :

B. monosperma (Lam.) Taub. : (Text-Fig. I : 1 A-C; Fig. 1).

Pollen grains 3-zonocolporate, ectocolpium long, 30 × 8 μm, ends broadly round. Endocolpium lalongate, 6 × 10 μm. Exine reticulate, heterobrochate, muri simple columellate. Exine 2 μm thick; ectexine as thick as endexine, semitectate. Grain size 38 × 37 μm (35-40 × 35-39 μm). Prolate spheroidal, Amb tri-lobate. Apocolpium dia. 5 μm.

B. superba Roxb. ex Willd. : (Text-Fig. I : 2 A-C; Fig. 2).

Grains 3-zonocolporate, ectocolpium long and broad, 37 × 6 μm, ends round. Endocolpium lalongate (circular rarely) 8 × 6 μm. Exine reticulate, heterobrochate, 2 μm thick; ectexine as thick as endexine, semitectate. Grain size 52 × 44 μm (44-55 × 38-44 μm). Prolate spheroidal. Amb triangulate.

Section *Meizotropis* :

B. buteiformis (Voigt) Grierson & Long. : (Text-Fig. I : 3 A-C; Fig. 3).

Grains 3-zonocolporate, ectocolpium brevicolpate, apiculate 18 × 8 μm. Endocolpium circular, dia. 10 μm. Exine rugulate-verrucate, 2 μm thick, ectexine as thick as endexine, tectate. Grain size 39 × 37 μm (35-39 × 36-40 μm). Prolate spheroidal. Amb circular.

B. pellita Hook. f. ex Prain : (Text-Fig. I : 4 A-C; Fig. 4).

Grains 3-zonocolporate, ectocolpium shallow and faint, ends acute, 20 × 3 μm. Endocolpium lalongate (rarely circular) 7 × 9 μm. Exine verrucate, 2.5 μm thick, tectate. Grain size 31 × 30 μm (30-31 μm). Prolate spheroidal. Amb circular.

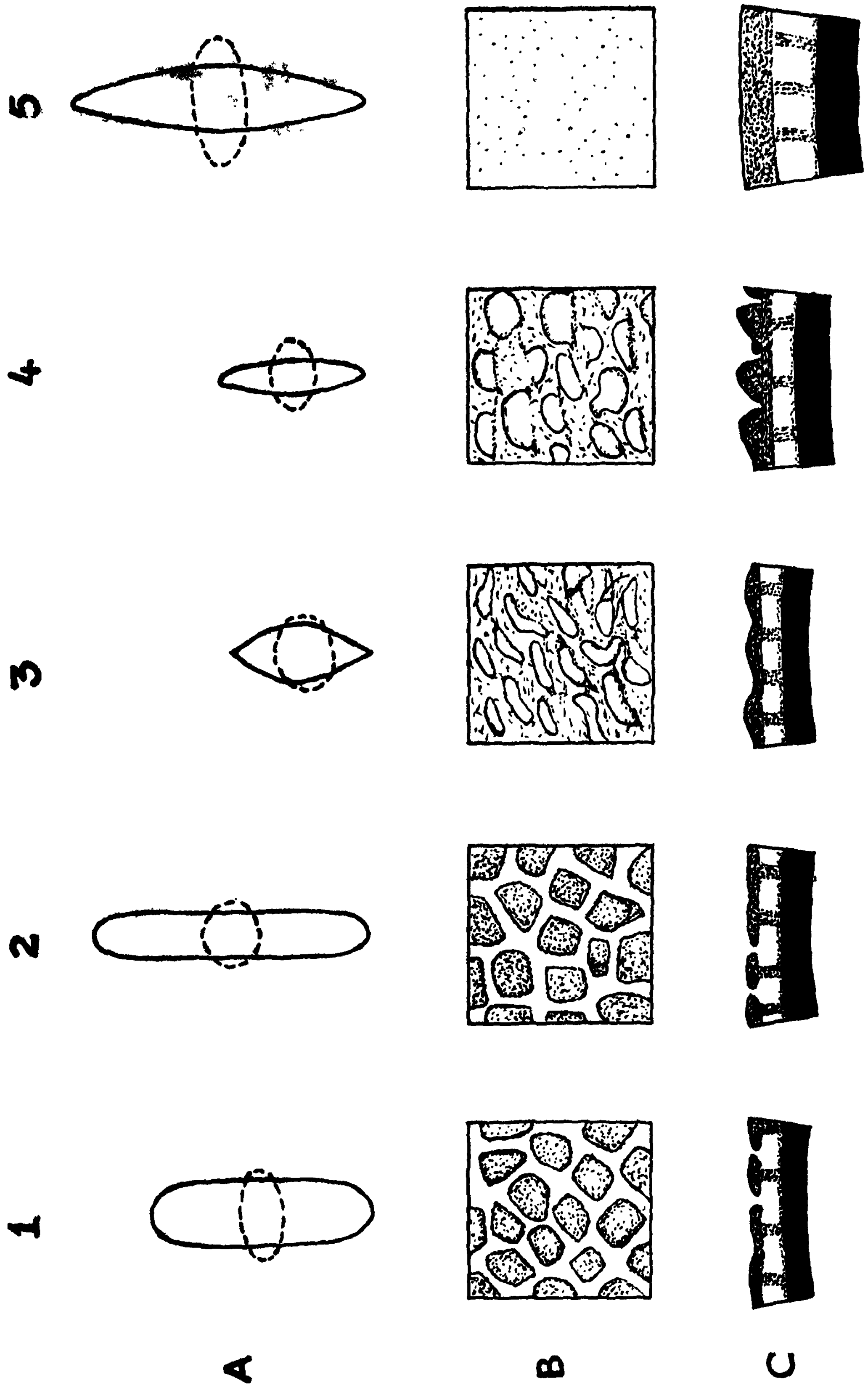
Section *Spatholobus* :

B. parviflora Roxb. ex DC. : (Text-Fig. I : 5 A-C; Figs. 5 & 6).

Grains 3-zonocolporate, ectocolpium 40 × 8 μm, ends round. Endocolpium lalongate 6 × 18 μm. Exine psilate, 3 μm thick; ectexine thicker than endexine, tectate. Grain size 45 × 44 μm (45-48 × 44-46 μm). Prolate spheroidal. Amb circular.

KEY TO THE SPECIES STUDIED

Exine surface psilate, tectate	..	*B. parviflora*
Exine surface reticulate, semitectate:		
Grains 38-45 × 37 μm	..	*B. monosperma*
Grains 52 × 44 μm	..	*B. superba*
Exine surface rugulate-verrucate, tectate:		
Exine rugulate-verrucate (faintly)	..	*B. buteiformis*
Exine verrucate	..	*B. pellita*



Text-Fig. I : Pollen characters of *Butea* species : 1. *B. monosperma*. 2. *B. Superba*. 3. *B. buteiformis*. 4. *B. pellita*. 5. *B. parviflora*. A. aperture × 1,000. B. exine surface. C. exine structure, × 5,000.

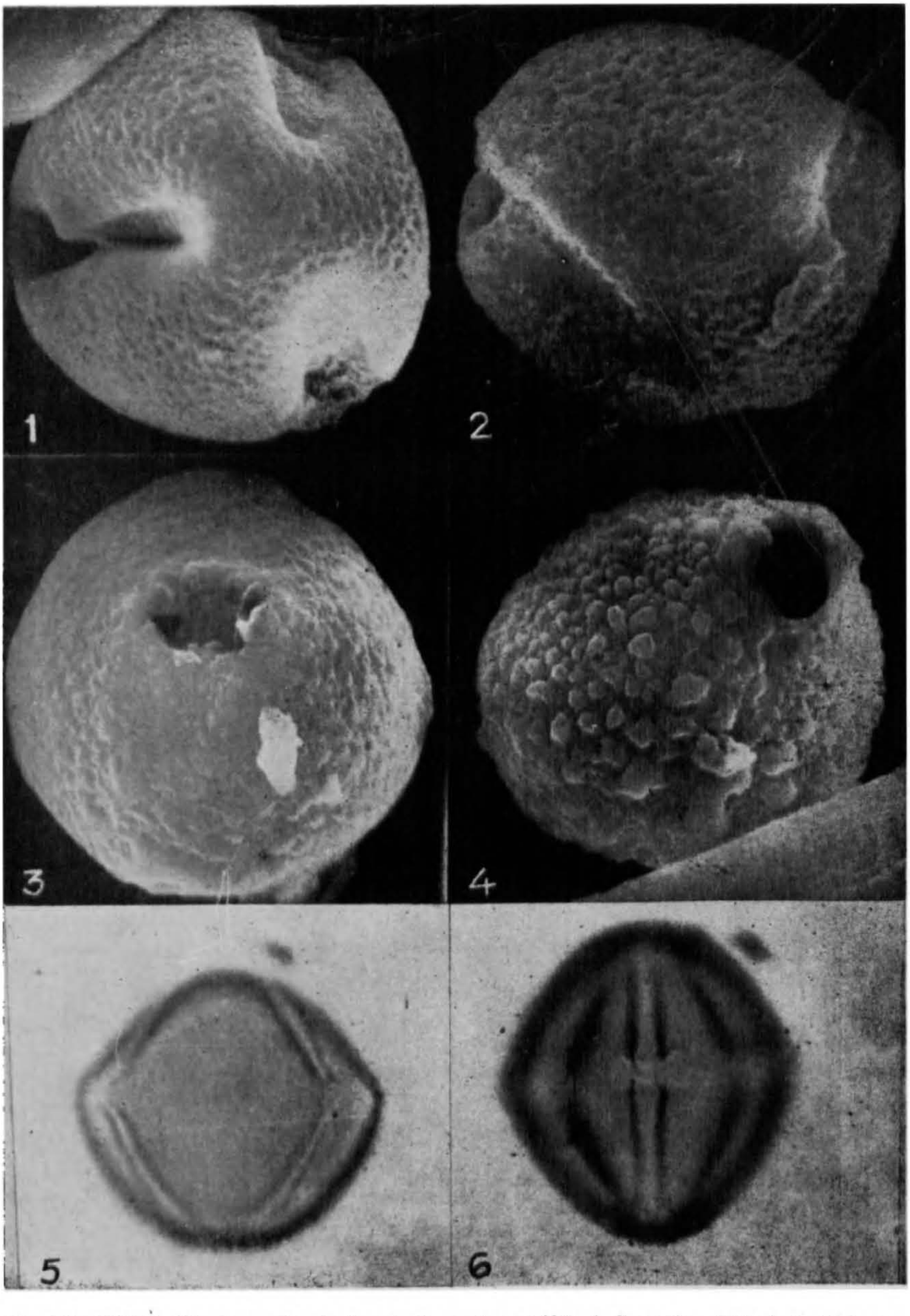


Fig. 1-6 : SEM & LM micrographs of pollen. 1. *B. monosperma* ×1800. 2. *B. superba* ×1800. 3. *B. buteiformis* ×2300. 4. *B. pellita* ×2200. 5. & 6. *B. parviflora* (LM) ×1,000.

DISCUSSION

The pollen grain structure is clearly defined and offer so many characters of taxonomic value, such as aperture, exine structure and ornamentation, size and shape. These characters are as useful as other characters in the classification of plants. An analysis of pollen characters among the species of *Butea* (*s.l.*) are as follows :

Aperture : In general the pollen are 3-zonocolporate in all the species studied. But they do differ in the size and shape of the ecto- and endo-colpium (Text-Fig. I : A). The ectocolpium is long (30-40 μm) and the ends are broadly rounded in the species *B. monosperma*, *B. superba* and *B. parviflora*, whereas it is short (18-20 μm) with pointed ends in *B. buteiformis* and *B. pellita*. The endocolpium is lalongate in *B. parviflora*, *B. monosperma* and *B. pellita*, circular in *B. buteiformis* and lalongate-circular in *B. superba*.

Exine : There is a great diversity in the exine ornamentation and structure (Text-Fig. I : B & C). Three exine morphotypes have been recognised, which represent the three sections Eubutea, Meizotropis and Spatholobus as mentioned below :

Butea type : Exine semitectate, reticulum elevated on columellae and muri psilate (Text-Fig. I : 1B & 2B).

Meizotropis type : Exine tectate, surface rugulate-verrucate (Text-Fig. I : 3B & 4B).

Spatholobus type : Exine tectate, surface psilate (Text-Fig. I : 5B).

Size and Shape : The pollen grain size variation within the sections in meagre, however, the grains are smaller (30-35 μm) in the section Meizotropis, while larger (40-50 μm) in Eubutea and Spatholobus. The pollen are prolate spheroidal in the species studied.

PALYNOTAXONOMY

From the present study the occurrence of three pollen types within the genus *Butea* (*s.l.*) apparently suggest the presence of three natural groups, equivalent to the sections *Eubutea*, *Meizotropis* and *Spatholobus* of Blatter (1929). The pollen in Eubutea are large semitectate, reticulate with long ectocolpium, whereas in Meizotropis pollen are smaller tectate, verrucate with short ectocolpium and in Spatholobus pollen are large, tectate, psilate with long ectocolpium bear the evidence that these sections represent separate genetic lines and warrant reassessment of *Butea* Roxb. ex Willd., *Meizotropis* Voigt, and *Spatholobus* Hassk.

Spatholobus Hassk. was treated as a distinct genus by Hutchinson (1964), Lackey (1981) and by Ridder-Numan and Wiriadinata (1985). The elimination of the section Spatholobus from *Butea*, left the genus with four species as mentioned by Prain (1908). Prain pointed out that the generic definition of Bentham (1865) and Taubert (1894) excludes the species *B. minor*, however for convenience he accorded sectional rank to the group *Meizotropis*. *Meizotropis* Voigt was treated as a distinct genus by Sanjappa (1988) in his taxonomic revision of the genera *Butea* and *Meizotropis*. The detailed palynological survey provided an opportunity to supplement the above macromorphological approaches. Now the circumscription of the genus *Butea* is altered and reduce the number of species to two.

Therefore based on the pollen characters and other morphological characters *Butea* Roxb. ex Willd., *Meizotropis* Voigt and *Spatholobus* Hassk., are now better recognised as distinct genera.

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